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**(19) AUSTRALIAN PATENT OFFICE**

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**(10) Patent No. 575845**

**(54) Title**  
**LIGHT ABSORBER FOR SMOKE DETECTOR**

**(51) International Patent Classification(s)**  
**G02B 005/02                      G08B 017/10**

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**(54) Inventor(s)**  
**Martin Terence Cole**

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(NON-CONVENTION. By one or more persons and/or a Company.)

575845

Form 1.

31842/84

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APPLICATION ACCEPTED AND AMENDMENTS  
ALLOWED 24.6.88

## APPLICATION FOR A PATENT

COMPLETE AFTER PROVISIONAL SPECIFICATION No. 31842/84

(1) Here  
insert (in  
full) Name  
or Names of  
Applicant or  
Applicants,  
followed by  
Address (es).

1 (1) MARTIN TERENCE COLE  
X of 7 Loxwood Avenue, Keysborough,  
Victoria, Australia, 3173

(2) Here  
insert Title  
of Invention.

hereby apply for the grant of a Patent for an invention entitled: (2)  
"IMPROVEMENTS RELATING TO LIGHT ABSORBERS"

which is described in the accompanying ~~PROVISIONAL~~ specification.

My address for service is Messrs. Edwd. Waters & Sons, Patent Attorneys,  
50 Queen Street, Melbourne, Victoria, Australia.

LODGED AT SUB-OFFICE  
12 AUG 1983  
Melbourne

DATED this 11<sup>th</sup> day of August 1983  
MARTIN TERENCE COLE

20- PAID  
RECEIPT No. 5610

AGENT  
PATENT TRADE MARKS  
& DESIGNS OFFICE

By my Patent Attorneys  
EDWD. WATERS & SONS

(3) Signa-  
ture (s) of  
Applicant (s)  
or  
Seal of  
Company and  
Signatures of  
its Officers as  
prescribed by  
its Articles of  
Association.

By: L.J. Dyson  
Registered Patent Attorney

To:

THE COMMISSIONER OF PATENTS

One or more persons.)

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31842/84

# DECLARATION IN SUPPORT OF AN APPLICATION FOR A PATENT OR PATENT OF ADDITION

(1) Here  
insert (in  
full) Name of  
Applicant or  
Applicants.

In support of the Application made by<sup>(1)</sup>  
MARTIN TERENCE COLE

(2) Here  
insert title  
of Invention.

for a Patent.....for an invention entitled:<sup>(2)</sup>  
"IMPROVEMENTS RELATING TO LIGHT ABSORBERS"

I<sup>(1)</sup> MARTIN TERENCE COLE  
~~XXXe~~

(3) Here  
insert (in  
full) Address  
or Addresses.

of<sup>(3)</sup> 7 Loxwood Avenue, Keysborough, Victoria,  
Australia, 3173

do solemnly and sincerely declare as follows:

1. I am  
~~We are~~ the applicant for the patent.
2. I am  
~~We are~~ the actual inventor of the invention.

—or—

(4) Here  
insert full  
Name(s) and  
Address(es)  
of Actual  
Inventor(s) if  
other than  
Applicant.

2<sup>(4)</sup>

the actual inventor of the invention, and the facts upon which I am  
~~We are~~ entitled to  
make the application, are as follow:

(5) Full Name  
of Actual  
Inventor or  
Inventors.

I am  
~~We are~~ the assignee of the said<sup>(5)</sup>

DECLARED at Keysborough

this Eleventh day of August 1983

(6) Signature  
of Applicant or  
Applicants.

(6)

To:

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(12) PATENT ABRIDGMENT (11) Document No. AU-B-31842/84  
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 575845  
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(54) Title  
LIGHT ABSORBER FOR SMOKE DETECTOR

(51) 4 International Patent Classification  
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(60) Related to Provisional(s) : PG0821

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MARTIN TERENCE COLE

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EDWD. WATERS & SONS

(56) Prior Art Documents  
US 4315158  
US 4166960  
US 3185975

(57) Claim

1. A light absorber comprising a body at one side of which is a face having a centre encircled by an annular groove having a base and opposed, radially inner and outer walls, said walls of said groove being so inclined relatively to one another that the radially inner wall forms a conical surface extending from said center inwardly from said face.

575845

Form 10

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952-69

# COMPLETE SPECIFICATION

(ORIGINAL)

Class

Int. Class

Application Number: PG 0821/83  
Lodged: 12th August 1983

Complete Specification Lodged:  
Accepted: 31842184  
Published:

Priority:

Related Art:

Name of Applicant: MARTIN TERENCE COLE

Address of Applicant: 7 Loxwood Avenue, Keysborough, Victoria, Australia

Actual Inventor: MARTIN TERENCE COLE

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50 QUEEN STREET, MELBOURNE, AUSTRALIA, 3000.

Complete Specification for the invention entitled:

IMPROVEMENTS RELATING TO LIGHT ABSORBERS

The following statement is a full description of this invention, including the best method of performing it known to me

IMPROVEMENTS RELATING TO LIGHT ABSORBERS

The present invention relates to a light absorber device which is effective to prevent or restrict reflection of light perpendicular to its surface over a wide range of  
5 incident angles.

The light absorber of the present invention has particular though not exclusive application in extremely sensitive optical smoke detectors incorporating at least one tubular sampling chamber including a light sensing  
10 device at one end, a light absorber at the other end, a light source projected across the tube, means for taking continuous samples of surrounding air whereby when smoke is present light impinges on the sensing device thereby creating an alarm situation. Thus, by detecting the  
15 presence of smoke it may be possible to indicate the presence of fire at a very early stage so that action can be taken prior to major damage being caused. Unfortunately, sufficiently sensitive known apparatus is subject to spurious response because of lack of, or poorly controlled  
20 sensitivity. Furthermore, such known smoke detection apparatus are rather large and heavy, and require relatively high powers to operate them.

One important aspect of smoke detector construction is to provide an air sampling tube of short length.

25 One factor which contributues to the overall dimension of the chamber is the provision of an effective light absorber. The absorber is designed to prevent light from being reflected perpendicular to the surface of the absorber. Thus, when installed into a sampling chamber the  
30 absorber prevents light directed towards the absorber from any angle being reflected back along the sampling chamber towards the light sensing device thus no light should be reflected axially along the sampling chamber.

35 Devices are known utilising a blackened inclined plane to reflect light towards the blackened walls of said sampling chamber, thereby to absorb light by at least three

lossy reflections before the remnant light can be returned in the direction of said detector element.

Another known absorber utilises a blackened cone, concentric with said sampling chamber. This has the advantage of halving the length which would have been occupied by said inclined plane, assuming the half-apex angle of said cone equals the angle of inclination of said plane to said sampling chamber. The external length of said sampling chamber is thereby reduced.

The present invention is particularly adapted for use with a high intensity flash reflector as disclosed in my co-pending Australian Patent Application No. PG0822/83 filed 12th August 1983, and a sampling chamber disclosed in my co-pending Australian Application No. PG0820/83 both filed 12th August 1983.

The sampling chamber is particularly suited for use with the sampling device or point disclosed in my co-pending Australian Application No. PG 0116/83 filed 4th July 1983.

Cross-reference is also made to my co-pending Australian Application No. PG1975/83 filed on 21st October 1983, disclosing optical air pollution monitoring apparatus and No. PG4919/84 filed on 9th May 1984, disclosing an improved solid state anemometers and temperature, all of which are hereby incorporated herein as part of the disclosure.

The present invention has a principal objective the provision of a light absorber which is effective yet simple to construct.

~~There is provided according to the present invention a light absorber including a substantially central light receiving conical surface surrounded by at least one annular conical surface to provide at least one annular groove or valley surrounding said central conical surface.~~

~~There is provided according to a specific aspect of the present invention a light absorber including a central~~



- 3a -

There is provided according to the present invention a light absorber comprising a body at one side of which is a face having a centre encircled by an annular groove having a base and opposed, radially inner and outer walls, said walls of said groove being so inclined relatively to one another that the radially inner wall forms a conical surface extending from said center inwardly from said face.

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~~light receiving conical surface surrounded by at least one annular groove or valley surrounding said central cone wherein one wall of the groove or valley is undercut to shade the base of the groove or valley from direct~~  
5 ~~impinging light.~~

Conveniently, there are a plurality of undercut valleys in a cylindrical body constituting the absorber device. The surface of the device is coated with a material which is highly light absorptive. The absorber of the  
10 present invention will absorb light with greater efficiency while occupying a length at least 3 times shorter than a simple cone absorber and at least 6 times shorter than an inclined plane absorber as mentioned above.

Thus, the present invention when applied to an  
15 optical smoke sampling chamber is not only effective in minimising the external length of the chamber but is more effective. Thus, the number of applications in which the smoke detector fitted with the absorber can be used is increased because of its compactness. The invention will be  
20 described with reference to the accompanying drawings in which:-

Figure 1 shows a cross sectional view of an absorber mounted at one end of a sampling tube part of which is shown

Figure 2 shows a cross sectional view of a sampling tube showing the location of major components including a light absorber made according to the present invention.

In a preferred embodiment of this invention, a short  
30 cylinder 10 is machined to produce one substantially central external conical surface, preferably surrounded by two concentric truncated external conical surfaces 12, 13. Between each adjacent conical surface 11, 12, 13 there are provided two internal concentric conical surfaces 12a, 13a which are undercut. Said undercut enables each peak 14 to  
35 shade each valley or groove base 15. The radius of each valley cannot be infinitely small, and would otherwise be capable of reflecting a small amount of light axially



along said sampling chamber. Equally importantly, incident axial light becomes trapped within the confines of the inclined surfaces and suffers lossy reflection at least five times before emerging, extremely attenuated, in a non-axial direction. This cannot be achieved with the simple cone or inclined plane designs. In a preferred embodiment the angle of under cut is approximately  $5^{\circ}$  from the axis of the chamber, and the external cone angle is approximately  $30^{\circ}$ .

In a compromise design for less critical applications in terms of sensitivity, it is possible to utilise two external conical surfaces and not to undercut the internal conical surfaces, resulting in an absorber of lower efficiency but still providing the advantage of short length.

With reference to figure 2 the sampling tube includes a light source 60 with associated reflector. A lense 40 near a light sensing device 30. If the area adjacent the light source 60 fills with smoke, light impinges on the particles and is transmitted axially along the tube past light baffles 21 to lense 40 and will impinge upon the light sensor 30. Light baffles 21 and 22 are spaced along the tube to catch stray light impinging at various incident angles. The absorber 10 with its central cone is positioned on the longitudinal axis aligned with the central axis of the lense and the light sensor. Thus, any light which is directed to the back of the sampling chamber will not be reflected back along the sampling chamber toward the sensor 30. Therefore negligible light is reflected axially along the sampling chamber.

The absorber is sealingly mounted in the end of the sampling chamber as a press fit. Sealing of the absorber into the chamber is assured by the provision of O-ring seals 16. This facilitates removal of the absorber to allow access to the sampling chamber for servicing purposes while providing a sealing facility for the chamber where it is

required to be operated at other than atmospheric pressure.

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**CLAIMS**

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A light absorber comprising a body at one side of which is a face having a centre encircled by an annular groove having a base and opposed, radially inner and outer walls, said walls of said groove being so inclined relatively to one another that the radially inner wall forms a conical surface extending from said center inwardly from said face.
2. A light absorber according to claim 1 wherein said annular groove is encircled by at least one additional concentric annular groove, said additional groove having a base and opposed radially inner and outer walls.
3. A light absorber according to claim 2 wherein the radially inner and outer walls of said additional groove parallel the radially inner and outer walls, respectively, of the first mentioned annular groove.
4. A light absorber according to any one of the preceding claims wherein the radially outer wall of said or each groove is undercut and overhangs the base thereof.
5. A light absorber according to claim 4 wherein said face is planar except for said groove.
6. A light absorber according to claim 4 or claim 5 wherein the radially inner and radially outer walls converge in a direction inwardly of said face.
7. A light absorber according to claim 4, 5 or 6 wherein said radially outer wall is undercut by 5°.



8. A light absorber according to any one of the preceding claims wherein said radially inner wall is inclined at an angle of ~~30°~~<sup>60° to</sup> inwardly of said face.

9. A light absorber according to any one of the preceding claims including a tubular member and means sealingly mounting said body within said tubular member at one end thereof.

10. A light absorber according to any one of the preceding claims including a light absorptive coating on said face, said radially inner and radially outer walls.

DATED this 23rd day of March, 1988

MARTIN TERENCE COLE

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LJD/PNF:EK(4.39)



**DRAWINGS**

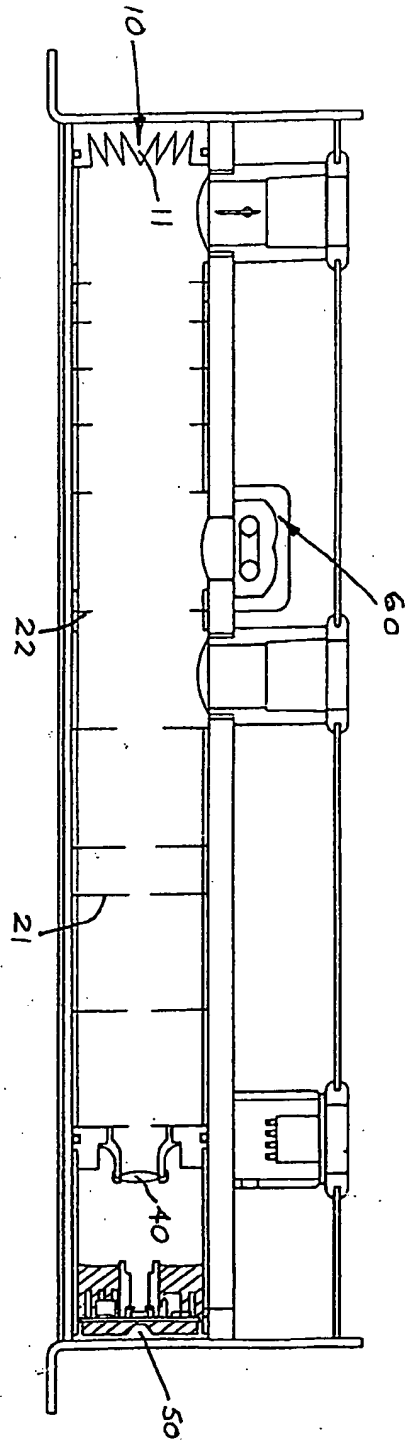


FIG. 2.

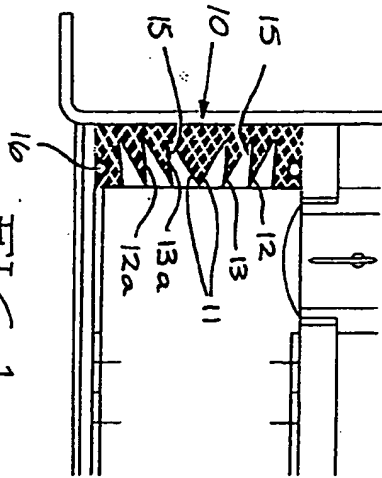


FIG. 1.



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